

14. An image pickup apparatus according to claim 10, wherein an iris is changed at high speed in order to change the exposure amount.

15. An image pickup apparatus according to claim 11, wherein an iris is changed at high speed in order to change the exposure amount.

REMARKS

The claims now pending in the application are Claims 1 to 15, the independent claims being Claims 1 to 3, 10 and 11. Claims 1 to 3, 10 and 11 have been amended.

In the Official Action dated December 28, 2001, Claims 1, 2, 4, 5, 7, 8, 10, 12 and 14 were rejected under 35 U.S.C. § 103(a), as unpatentable over U.S. Patent No. 5,162,914 (Takahashi, et al.), in view of U.S. Patent No. 5,235,427 (Kim), further in view of U.S. Patent No. 5,949,481 (Sekine, et al. '481), and further in view of U.S. Patent No. 4,272,787 (Michael, et al.). Claims 3, 6, 9, 11, 13 and 15 were rejected under 35 U.S.C. § 103(a), as unpatentable over the Takahashi, et al. in view of U.S. Patent No. 6,130,709 (Sekine, et al. '709) and the Sekine, et al. '481 patent and the Michael '787 patent.

Reconsideration and withdrawal of the rejections respectfully are requested in view of the above amendments and the following remarks.

The rejections of the claims over the cited art respectfully are traversed. Nevertheless, without conceding the propriety of the rejections, Claims 1 to 3, 10 and 11 have been amended herein more clearly to recite various novel features of the present

invention, with particular attention to the Examiner's comments. Support for the proposed amendments may be found in the original application. No new matter has been added.

The present invention relates to a novel apparatus and method for increasing an apparent dynamic range of a video signal by synthesizing a single image from a plurality of images sequentially picked up at different exposure amounts. In one aspect, as now recited in independent Claim 1, the image pickup method includes detecting a motion vector of a video signal, and if the detection result indicates that the motion vector is larger than a predetermined threshold value, a plurality of images are added to produce a corresponding portion of an image.

Independent Claims 2, 3, 10 and 11 recites similar features with respect to an image pickup method or apparatus.

Applicant submits that the prior art fails to anticipate the present invention. Moreover, Applicant submits that there are differences between the subject matter sought to be patented and the prior art, such that the subject matter taken as a whole would not have been obvious at the time the invention was made to one of ordinary skill in the art.

The Takahashi, et al. patent relates to an image sensing device with diverse storage fumes used in picture composition, and discloses an image sensing device adapted to compose an appropriate single picture from a plurality of pictures of different exposures obtained from the same subject, wherein the camera operation is controlled using as a reference one of the plurality of pictures of different exposures. However, as acknowledged in the Official Action, the Takahashi, et al. patent fails to disclose or suggest

the feature of detecting a motion vector, and moreover further fails to teach or suggest the feature of controlling image synthesization according to the detected motion vector.

The Kim patent discloses a method and apparatus for detecting a shaking condition of a camcorder, and temporarily halting or suspending operation of the camcorder while the camcorder is shaking excessively. However, Applicant submits that the Kim patent fails to disclose or suggest at least the above-described features of the present invention. Rather, Applicant submits that the Kim patent merely teaches a method of stopping operation of the camcorder when the vibration detected by a mercury switch is larger than a predetermined value. Moreover, the combination of Kim and Takahashi, et al. merely teaches inhibiting image synthesization when a motion vector is sufficiently large; nowhere do these patents, alone or in combination, disclose or suggest the feature of adding a plurality of images to produce a corresponding portion of an image when a detected motion vector is larger than a predetermined value, as disclosed and claimed in the present application.

The Sekine, et al. '481 patent relates to an image sensing and processing device, and was cited merely for its disclosure of the feature of detecting a motion vector. Similarly, the Sekine, et al. '709 patent relates to an image processing apparatus for correcting image vibration, and was cited merely for its disclosure of the feature of transforming coordinates of an image in accordance with a motion vector. Applicant submits that neither the Sekine, et al. '481 patent nor the Sekine, et al. '709 patent discloses or suggests at least the above-described features of the present invention. In particular, neither Sekine, et al. reference discloses or suggests the feature of adding a

plurality of images to produce a corresponding portion of an image when a detected motion vector is larger than a predetermined value.

Newly cited Michael, et al. discloses the feature of outputting a still image from TV video images in response to a freeze instruction. When motion is detected between fields of an input video signal, an output image is selected in a different manner that is in accordance with the detection result of the motion when the freeze instruction is produced. In particular, when motion is detected, a switch 18 is held in position A (for example), while when motion is not detected, the switch 18 is allowed to move between positions A and B (see Figure 5). Thus, in Michael, et al. only a single image is output regardless of the detection of motion. Accordingly, the Michael, et al. patent fails to disclose or suggest the feature of adding a plurality of images to produce a corresponding portion of an image when motion is detected, as disclosed and claimed in the present application.

Applicant, respectively submits that the Michael, et al. patent does not remedy the deficiencies of any combination of Takahashi, et al., Kim, Sekine, et al., '481, and Sekine, et al. '709.

For the above reasons, Applicant submits that independent Claims 1 to 3, 10 and 11 are allowable over the cited art.

Claims 4 to 9 and 12 to 15 depend from one or another of the independent claims, and are believed allowable for the same reasons. Moreover, each of these dependent claims recites additional features in combination with the features of its

respective base claim, and is believed allowable in its own right. Individual consideration of the dependent claims respectfully is requested.

Applicant requests that the present Amendment be entered under 37 CFR § 1.116. Applicant submits that the present amendments merely are minor or formal in nature, and reduce the number of issues for consideration. Applicant believes the present Amendment was necessitated by the outstanding Official Action, and submits that the present amendments were not previously made because Applicant believed the prior claims were allowable.

Applicant believes that the present Amendment is responsive to each of the points raised by the Examiner in the Official Action, and submits that the application is in allowable form. Favorable consideration of the claims and passage to issue of the present application at the Examiner's earliest convenience earnestly are solicited.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

Shawn W. Fraser

Shawn W. Fraser
Attorney for Applicant
Registration No. 45,886

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-3801
Facsimile: (212) 218-2200

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VERSION WITH MARKS TO SHOW CHANGES MADE TO CLAIMS

1. (Twice Amended) An image pickup method for increasing an apparent dynamic range of a video signal by selecting a proper exposure portion [synthesizing a single image] from a plurality of images sequentially picked up at different exposure amounts, wherein a motion vector of a video signal is detected, and if the detection result indicates that the motion vector is larger than a predetermined threshold value, a plurality of images are added to produce a corresponding portion of an image [image synthesization is not performed, and a respective single image which is not synthesized is produced].

2. (Twice Amended) An image pickup method for increasing an apparent dynamic range of a video signal by selecting a proper exposure portion [synthesizing a single image] from a plurality of images sequentially picked up at different exposure amounts, comprising:

a motion vector detecting step of detecting a motion vector between corresponding pixels in the plurality of images;

a vector difference detecting step of detecting a difference between a motion vector detected in said motion vector detecting step and a motion vector between the plurality of images;

a comparison step of comparing the detection result of said vector difference detecting step with a predetermined threshold value; and

a synthesization inhibiting step of inhibiting image synthesization if the comparison result in said motion vector comparison step is larger than the predetermined threshold value, [wherein a respective single image which is not synthesized is produced] and a plurality of images are added to produce a corresponding portion of an image.

3. (Twice Amended) An image pickup method for increasing an apparent dynamic range of a video signal by selecting a proper exposure portion [synthesizing a single image] from a plurality of images sequentially picked up at different exposure amounts, comprising:

 a motion vector detecting step of detecting a motion vector between corresponding pixels in the plurality of images;

 a vector difference detecting step of detecting a difference between a motion vector detected in said motion vector detecting step and a motion vector between the plurality of images;

 a comparison step of comparing the detection result of said vector difference detecting step with a predetermined threshold value;

 a coordinate converting step of performing a coordinate conversion of the plurality of images in correspondence with an image shift caused by a time difference when the plurality of images are picked up, if the comparison result at said motion vector comparison step is smaller than the predetermined threshold value: and

 an image synthesizing step of synthesizing the plurality of images with the image shift corrected at said coordinate converting step, into a single image, if the comparison result at said motion vector comparison is larger than the predetermined

threshold, wherein said image synthesizing step is inhibited and a plurality of images are added to produce a corresponding portion of an image [respective single image which is not synthesized is produced] if the comparison result at said motion vector comparison is smaller than the predetermined threshold.

10. (Twice Amended) An image pickup apparatus in which an apparent dynamic range of a video signal is increased by selecting a proper exposure portion [synthesizing a single image] from a plurality of images sequentially picked up at different exposure amounts, comprising:

motion vector detecting means for detecting a motion vector of the video signal;

comparison means for comparing a detection result by said motion vector detecting means with a predetermined threshold value; and

synthesization inhibiting means for inhibiting image synthesization if the comparison result by said comparison means is larger than the predetermined threshold value, while a plurality of images are added to produce a corresponding portion of an image [respective single image which is not synthesized is produced].

11. (Twice Amended) An image pickup apparatus in which an apparent dynamic range of a video signal is increased by selecting a proper exposure portion [synthesizing a single image] from a plurality of images sequentially picked up at different exposure amounts, comprising:

motion vector detecting means for detecting a motion vector between corresponding pixels in the plurality of images;

vector difference detecting means for detecting a difference between a motion vector detected by said motion vector detecting means and a motion vector between the plurality of images;

comparison means for comparing the detection result by said vector difference detecting means with a predetermined threshold value;

coordinate converting means for performing a coordinate conversion of the plurality of images in correspondence with an image shift caused by a time difference when the plurality of images are picked up, if the comparison result by said motion vector comparison means is smaller than the predetermined threshold value; and

image synthesizing means for synthesizing the plurality of images with the image shift corrected by said coordinate converting means, into a single image, if the comparison result at said motion vector comparison is larger than the predetermined threshold, wherein image synthesization by said image synthesizing means is inhibited while a plurality of images are added to produce a corresponding portion of an image [respective single image which is not synthesized is produced] if the comparison result at said motion vector comparison is smaller than the predetermined threshold.